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EVIDENCE OF THE HYBRID NATURE OF *BETULA* SANDBERGI

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(Plate 170)

IN a paper published in 1916¹ I called attention to two forms of *Betula* occurring in eastern Minnesota which showed evidence of being natural hybrids between some of the common native species of the region. One of these, already described by Britton² as *Betula Sandbergi*, was shown to be almost certainly a hybrid between *B. papyrifera* and *B. pumila* var. *glandulifera*, the other a hybrid between the latter species and *B. lutea*. No name was assigned to this combination as it was thought that it could hardly be identified with *Betula Purpusii* Schneider³ said to be a hybrid of *B. lutea* × *B. pumila* (not *B. pumila* var. *glandulifera*). However Schneider's *B. Purpusii* was a natural hybrid coming originally from "Clark's Lake," Mich. and typical *B. pumila* now appears not to occur in that state (See below, p. 108), so that Schneider's plant was in truth the hybrid of *B. lutea* × *B. pumila* var. *glandulifera* discussed in my former paper. His very brief description of *B. Purpusii* corresponds well with the Minnesota plant.

During the intervening years since 1916 *B. Sandbergi* has been found in several additional places throughout Hennepin, Ramsey and Anoka Counties and in the summer of 1927 it was collected in

¹ Rosendahl, C. O. Observations on *Betula* in Minnesota. *Minn. Bot. Stud.* 4: 443-459, 1916.

² Britton, N. L. Four new North American Birches. *Bull. Torr. Bot. Club.* 21: 166, 1904.

³ Schneider, C. K. *Ill. Handb. d. Laubholz.* 1: 102, 1904.

its typical form at two stations in Itasca Park. In the latter case, as in all previous instances of occurrence, both the parent species were present in relative abundance. *B. Purpusii* appears on the contrary to be rather scarce since only two stations have been added to the previous record, one in Ramsey County, the other in southern Pine County.

The assumption that these two birches were of hybrid nature was based on the presence of a number of intermediate characters together with a consistently high percentage of pollen sterility. No other evidence was available but since that time cultural experiments have shown the assumption to be correct in the case of one of the hybrids. In the original publication attention was called to the fact that attempts to grow the seeds of these hybrids were largely unsuccessful, only three seedlings of *B. Sandbergi* having been obtained. Two of these seedlings flourished for a number of years and almost from the beginning showed considerable difference in regard to habit and rate of growth. When about four years old one of them had attained a height of two feet while the other was about twice that size. This difference in rate of growth was nearly maintained until the time of death of the smaller shrub when it had reached a height of about $4\frac{1}{2}$ feet while the other was about 10 feet high. At the present time the latter has produced three stems from the original base which vary in height from 8 to 14 feet. It has essentially the aspect of the parent hybrid, except that the bark is somewhat lighter in color. The leaves of this shrub, however, resemble those of *B. papyrifera* except that they average somewhat smaller in size and have only 5-6 pairs of lateral veins instead of 7-8, the number in *B. papyrifera*. They show the conspicuous tufts of hairs in the axils of the main veins and the doubly serrated margins which characterize most specimens of the latter (text fig. 1, a, b). The fruiting catkins produced this year are slightly longer than in *B. Sandbergi* but the fruiting scales and nutlets are practically identical with the corresponding structures of the parent hybrid. It is interesting to note that all the nutlets examined are without fertile seeds and that the stamens in the catkins for next year contain almost 100% defective pollen.

The smaller one of the two shrubs resembled the local form of the Low Birch in the very slender branches and somewhat strict habit of growth but showed rather mixed leaf characters.

From the accompanying drawings (text fig. 1, c, d, e), made with a camera lucida, it can be seen that in form and size the leaves resemble very closely *B. Sandbergi* but they have the short petioles characteristic of *B. pumila* var. *glandulifera*. Unlike either of these, however, the leaves are permanently pubescent on both surfaces and furthermore the twigs at the end of the season are still quite pubescent.

A portion of the same seed collection from which the above described plants were obtained was sent to Dr. Sargent for cultivation at the Arnold Arboretum. Much better success was had with this lot and a few years later Dr. Sargent sent me five specimens from as many shrubs which are shown in the accompanying illustrations (Plate 170, Fig. 2-6). He also stated that several additional shrubs from the same crop were then (1917) growing in the parks at Rochester, N. Y.

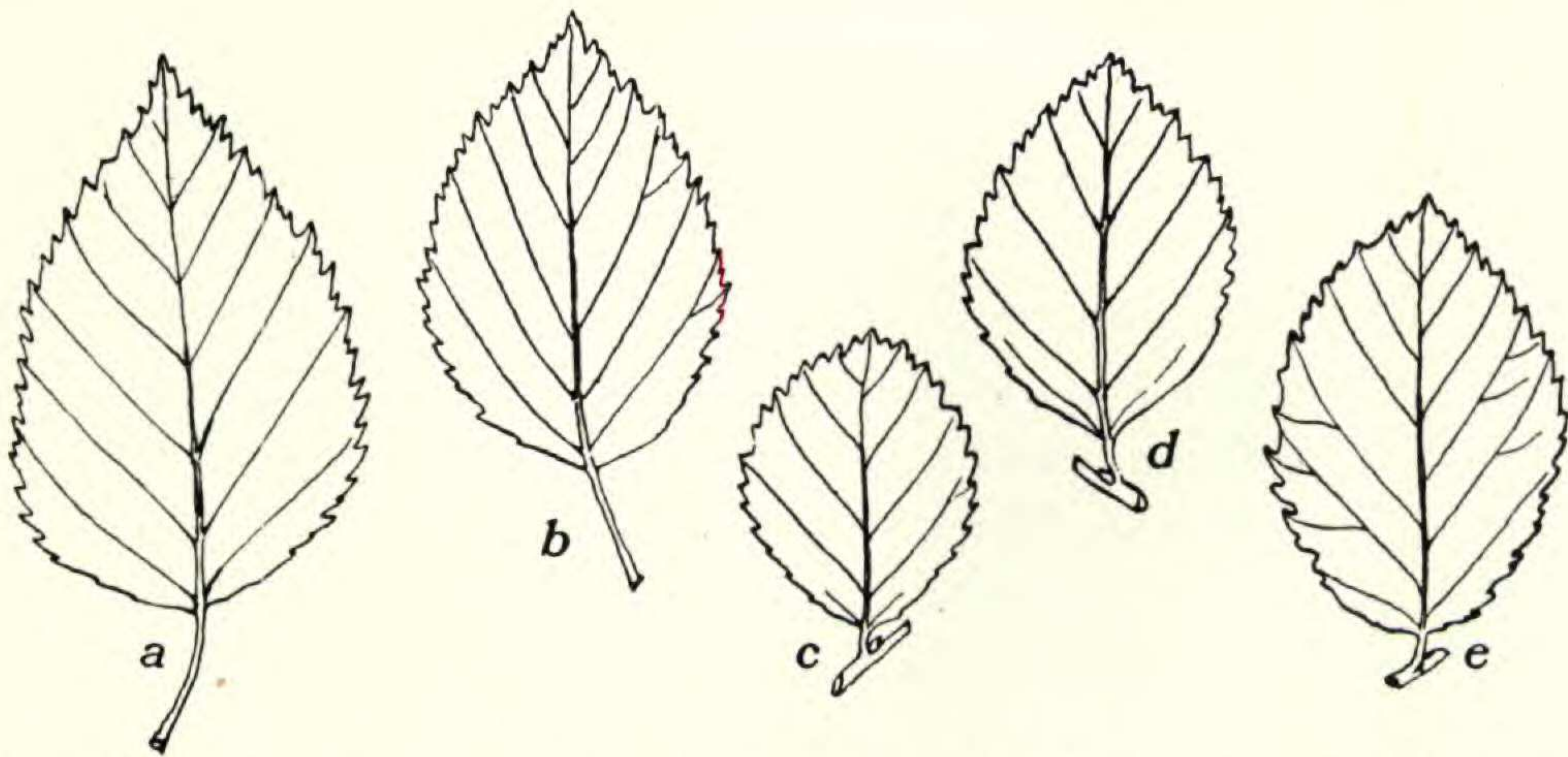


FIG. 1. F_2 segregates of *B. Sandbergi* cultivated at the University of Minnesota (see text).

Figure 1 of the photographic illustration shows a twig of the plant from which the seed was obtained and it represents the typical form of *B. Sandbergi* as it occurs commonly throughout this region. It is designated F_1 . Unfortunately there is no definite proof that it is the first generation hybrid but the consistent recurrence of this type in a number of places where the parent species abound would seem to justify the assumption. At any rate it is the seed parent of the plants shown in figures 2-6, Plate 170.

It is fairly obvious that fig. 3 is the only one of the offspring which resembles the parent somewhat closely in leaf-form. The texture, venation and serration are essentially the same and the only perceptible difference is in the smaller size of a number of the leaves, the

average being about 2.5 x 1.5 cm. against 3.5 x 2.8 cm. for the parent. Furthermore there are only 4 pairs of lateral veins to the leaves while the F_1 plants frequently have 5. The young twigs are glandular, finely puberulent, and sparingly pubescent in both. The specimen shown in figure 2 resembles *B. pumila* var. *glandulifera* somewhat closely but with the important exception that the leaves are persistently pubescent on both surfaces, especially along the mid-rib and the main lateral veins. Both leaves and young twigs are abundantly glandular-dotted and the segregation of characters of *B. pumila* var. *glandulifera* is clearly indicated.

In this connection it is worth noting that there are several collections in the University herbarium from different stations in Minnesota which resemble the plant shown in figure 3 very closely both as to form of leaf and pubescence and it is highly probable that they represent natural segregates from *B. Sandbergi*. It is significant that a very high percentage of sterile seeds has been found in all of these collections. The specimens in question had been identified as typical *B. pumila*, but while closely simulating that species they differ in having more slender branches, less orbicular leaves, slightly different serration and in being more or less gland-dotted. The writer is inclined to regard the reported occurrence of typical *B. pumila* in Minnesota, Wisconsin, Michigan and northern Indiana as based on similar segregating forms of *B. Sandbergi*. There are no specimens of typical *B. pumila* from these states in the Minnesota Herbarium and Dr. Butters who recently kindly examined the collections in the Gray Herbarium for me, reports that there also all reputed specimens of typical *B. pumila* from the above noted states appear to be segregates of *B. Sandbergi*.

The specimens illustrated in figures 4, 5 and 6 are clearly of a different type from those in figures 2 and 3. The leaves are distinctly ovate, with cordate or subcordate bases in contrast to the elliptic, rhombic to obovate form and narrowed bases of the others. They are all somewhat gland-dotted on both surfaces, pubescent along the veins and have much longer petioles. The young twigs have conspicuous resinous glands, and are sparingly pubescent.

Although the three specimens show some variation among themselves in regard to form and size of leaf the segregation of *B. papyrifera* characters is nevertheless quite obvious in all three. No opportunity has as yet been offered to check up on the bark, fruiting

catkins, nutlets and pollen of these shrubs in the Arnold Arboretum.

It should be added in conclusion that it has not been possible hitherto to secure any experimental evidence of the hybrid nature of *B. Purpusii* such as presented in the foregoing paragraphs for *B. Sandbergi*. Fruit has been collected from various stations and plantings made under different temperature conditions but no seedlings have been obtained. An examination of numerous nutlets from all the collections available has recently been made and in no cases were they found to contain seed. This, together with the uniform failure to get any germination, indicates a probable complete sterility of the hybrid for the Minnesota region at least. From a comment by Schneider (l. c. p. 102) it can be inferred that a plant in Darmstadt, which he designated as *B. Purpusii* var. *luteoides* was derived from the Michigan hybrid, although it is not expressly stated. If the inference is correct then it follows that the hybrid at least occasionally produces fertile seed and furthermore that segregation also takes place for he adds that the variety is a tree-like shrub resembling *B. lutea* much more closely than the shrubby plant from Clark's Lake which he names var. *typica*.

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EXPLANATION OF PLATE 170.

FIG. 1. *Betula Sandbergi* F₁ from Hennepin County, Minn.; FIGS. 2-6 F₂ segregates cultivated at the Arnold Arboretum from seed obtained from plant in FIG. 1 (see text).

AN UNCOMMON ASSOCIATION OF PINES IN NORTHERN NEW YORK

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DURING the latter part of May, 1925, while engaged in work connected with white pine blister rust control in the town of Chesterfield, Essex County, N. Y., for the New York Conservation Department, I noticed an old field which was growing up to pine. The conspicuous feature here was a dense grove of jack pine (*Pinus Banksiana*, Lamb.) occupying perhaps a tenth of an acre, the trees ranging from four to six inches in diameter and about 25 feet high. Growing in the same field were other groups and individuals of the jack pine, and also of pitch pine (*Pinus rigida*, Mill.), red pine (*P. resinosa*, Ait.) and a very few white pine (*P. Strobus*, L.). The